SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 9.—"On the Electromagnetic Theory of the Reflection and Refraction of Light," by George Francis Fitzgerald, M.A., Fellow of Trinity College, Dublin. Communicated by G. J. Stoney, M.A., F.R.S., Secretary of the Queen's University, Ireland.

I have thrown the expressions for the electrostatic and electrokinetic energy of a medium given by Prof. J. Clerk-Maxwell in his "Electricity and Magnetism," vol. ii. part iv. chap. II., into the same forms as M'Cullagh assumed to represent the potential and kinetic energy of the ether, in "An Essay towards a Dynamical Theory of Crystalline Reflection and Refraction," published in vol. xxi. of the *Transactions* of the Royal Irish Academy. Following a slightly different line from his, I obtain, by a quaternion and accompanying Cartesian analysis, the same results as to wave propagation, reflection, and refraction, as those obtained by M'Cullagh, and which he developed into the beautiful theorem of the polar plane. Of course, the resulting laws of wave propagation agree with those obtained by Prof. Maxwell from the same equations by a somewhat different method. For isotropic media, the ordinary laws of reflection and refraction are obtained, and the well-known expressions for the amplitudes of the reflected and refracted rays.

In the second part of the paper I consider the case of reflection at the surface of a magnetised medium, adopting the expressions Prof. J. Clerk Maxwell has assumed in "Electricity and Magnetism," vol. ii. part iv. § 824, to express the kinetic energy of such a medium.

I show that the method adopted in my former paper on Magnetic Reflection in the *Proceedings* of the Royal Society for 1876, No. 176, is justified, and that it is legitimate to consider an incident plane polarised ray as composed of two oppositely circularly polarised rays, each of which is reflected according to its own laws. I consider next the cases of the magnetisation being all normal to the surface, and all in the surface and the plane of incidence, and obtain the following result: When the incident ray is plane polarised, and the plane of polarisation is either in or perpendicular to the plane of incidence, the effect of magnetisation is to introduce a component into the reflected ray perpendicular to the original plane of polarisation, which vanishes at the grazing and normal incidences, and, in the case of iron, attains a maximum at about the angle of incidence $r = 63° 20'$.

I do not obtain any change of phase by reflection in any case; and this is to be expected, as this change of phase probably depends on the nature of the change from one medium to another, which, following M'Cullagh, I have uniformly assumed to be abrupt. Apart from this question of change of phase, my results conform completely to Mr. Kerr's beautiful experiments on the reflection of light from the pole of a magnet, as published in the Philosophical Magazines for May, 1877, and March, 1878.

"On Dry Fog," by E. Frankland, D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines.

January 16.—"Concluding Observations on the Locomotor System of Medusæ," by George J. Romanes, M.A., F.L.S. Communicated by Prof. Huxley, Sec. R.S.

The principal bulk of the paper is devoted to a full consideration of numerous facts and inferences relating to the phenomena of what the author terms "artificial rhythm." Some of these facts have already been published in abstract in the *Proceedings* of the Royal Society" (vol. xxv.), and to explain those which have not been published would involve more space than it is here desirable to allow. The tendency of the whole research on artificial rhythm, as produced in various species of Medusæ, is to show that the natural rhythm of these animals (and so probably of ganglio-muscular tissues in general) is due, not exclusively to the intermittent nature of the ganglionic discharge, but also in large measure to an alternate process of exhaustion and restoration of excitability on the part of the responding tissues—the ganglionic period coinciding with that during which the process of restoration lasts, and the ganglionic discharge being thus always thrown in at the moment when the excitability of the responding tissues is at its climax.

Light has been found to stimulate the lithocysts of covered-eyed Medusæ into increased activity, thus proving that these organs, like the marginal bodies of the naked-eyed Medusæ, are rudimentary organs of vision.

The polypite of *Aurelia aurita* has been proved to execute movements of localisation of stimuli somewhat similar to those which the author has already described as being performed by the polypite of *Tiaropsis indicans*.

Alternating the direction of the constant current in the muscular tissues of the Medusæ has the effect of maintaining the make and break stimulations at their maximum value; but the value of these stimulations rapidly declines if they are successively repeated with the current passing in the same direction.

In the sub-umbrella of the Medusæ waves of nervous excitation are sometimes able to pass when waves of muscular contraction have become blocked by the severity of overlapping sections.

Exhaustion of the sub-umbrella tissues—especially in narrow connecting isthmuses of tissue—may have the effect of blocking the passage of contractile waves.

Lithocysts have been proved sometimes to exert their ganglionic influence at comparatively great distances from their own seats—contractile waves, originating at points in the sub-umbrella tissue remote from a lithocyst, and ceasing to originate at that point when the lithocyst is removed. A nervous connection of this kind may be maintained between a lithocyst and the point at which the waves of contraction originate even after severe forms of section have been interposed between the lithocyst and that point.

When the sub-umbrella tissue of *Aurelia* is cut throughout its whole diameter, the incision will again heal up, sufficiently to restore physiological continuity, in from four to eight hours.

Chemical Society, January 16.—Dr. Gladstone, president, in the chair.—The following papers were read: On the action of isobutyric anhydride on the aromatic aldehydes, by W. H. Perkin. The author has studied the action of isobutyric anhydride on cuminic aldehyde, hydride of benzoyl, cinnamic aldehyde paroxybenzoic and anisic aldehydes. The bodies formed are respectively β isopropylbutenylbenzene, β butenylbenzene, butenylcinnamene, parabutenylphenol, and β parabutenylanisoïl.—On two new methods for the estimation of minute quantities of carbon and their application to water-analysis, by Drs. Dupré and Hake. The first consists in burning the substance in a current of oxygen in a combustion tube with oxide of copper, absorbing the carbonic acid in a Pettenkofer tube with baryta water, filtering off the barium carbonate with great care, converting it into chloride, then into sulphate, and weighing; in the second, the carbonic acid passes into a 2 per cent. solution of basic acetate of lead, and the turbidity compared with that produced by a solution of carbon of known strength in a Mills colorimeter.—On stannic ethide, by Dr. Frankland and Mr. A. Lawrance. By treating zinc ethyl with successive quantities of fused stannous chloride, the authors have prepared stannic ethide with great facility, they have also examined its properties, and specially investigated the action of sulphurous acid.—On aurin, by R. S. Dale and C. Schorlemmer. The authors have prepared pure aurin with great care, and confirmed the formula which they have already assigned to it. They have also studied ammonia aurin, tetrabromaurin, and the compounds formed by aurin with acetic, sulphuric, hydrochloric, and nitric acids.—On the derivatives of diisobutyl, by W. Carleton Williams.—On the action of chlorine upon iodine, by J. B. Hannay. The author confirms his previous conclusion, viz., that a body containing one atom of iodine and four atoms of chlorine does not exist.

Geological Society, January 8.—Henry Clifton Sorby, F.R.S., president, in the chair.—Charles Barrington Brown, Carl Fischer, M.D., F.L.S., William Coles Paget Medlycot, were elected Fellows; and Dr. F. V. Hayden, Washington, and M. Jules Marcou, Salins, Foreign Members of the Society.—The following communications were read:—On some tin-deposits of the Malayan Peninsula, by Patrick Doyle, C.E. (Communicated by the Rev. T. Wiltshire, F.L.S.) The tin-ore of the Malayan Peninsula is obtained from "stream-works" in an alluvial plain extending between a range of granitic mountains and the sea. The author describes the mines of the district of Larut Perak. The ore is got in open workings at an average depth of about 10 feet. The tin-bearing stratum has an average thickness of 4·87 feet; it is overlain by stratified sand and clay, and rests upon either porcelain clay or, sometimes, a sandstone. The ore varies from a fine sand, near the sea, to a coarse gravel, near the mountains, and is mixed with quartz, felspar, mica, and schorl. The author is of opinion that the stratum of ore has been derived from the granite of the mountain range, in which it still occurs in veins,

by denudation, and under conditions which still exist, though in a modified form.—Description of fragmentary indications of a huge kind of Theriodont reptile (*Titanosuchus ferox*, Owen), from Beaufort West, Gough Tract, Cape of Good Hope, by Prof. R. Owen, C.B., F.R.S. The author stated that among the fossils recently sent to the British Museum from the Cape of Good Hope by Mr. T. Bain, there were two boxes containing specimens of a most unpromising character, there being in them no entire bones, but only numerous more or less water-worn fragments. Among these was found a portion of a maxillary showing some traces of teeth; and sections having been made of this bone, the remains of several teeth were displayed, including a canine, the preserved portion of the socket of which was 4½ inches long. From the number and mode of implantation of the teeth, the author concluded that the animal to which they belonged resembled the Theriodont genera *Galesaurus* and *Galenops*. The anterior portion of the left ramus of the lower jaw, measuring 7½ inches in length, showed teeth presenting close analogies with those of Theriodonts, and this alliance was confirmed by the study of other fragments. Some of the characters presented by these remains seem to suggest affinities with the carnivorous mammalia, such as have been already indicated by the humeri of Theriodonts and Carnivores. The canine tooth of the new South-African reptile, which the author proposes to name *Titanosuchus ferox*, was six times as long as that of the allied form *Lycosaurus*; and we have in *Titanosuchus* evidence of a carnivorous reptile of more carnassial type than *Machairodus* and other felines. The author suggests that *Titanosuchus* found its prey in the contemporary *Pareiosauri*, Oudenodonts, and Tapinocephalans of the same locality.—Notes on the consolidated beach at Pernambuco, by J. C. Hawkshaw, M.A., F.G.S. The consolidated beach at Pernambuco, which has already attracted considerable notice, is a ridge of sandstone from 25 to 75 yards wide, and, as shown by borings made under the author's direction, from 10 to 13 feet thick. The landward or higher edge is nearly at the spring-tide high-water level, and it slopes seaward; the river (with a depth of 28 feet at low water 60 feet from the rock) flowing along the former face. The rise and fall of spring tides is 7 feet. Beneath the above rock is a stratum of sand with shells and stones about 8 feet thick, and then a second layer of sandstone rock. The consolidated beach is cemented by carbonate of lime, which the author considers to have been deposited by the action of water percolating through the rock, probably when the level of the land differed somewhat from what it is at present. He thinks it possible that this and other similar beaches on the Brazilian coast may mark periods of repose in the slow vertical movements which the coast has undergone.

Zoological Society, January 14.—Prof. Newton, F.R.S., vice-president, in the chair.—Dr. Traquair, F.R.S.E., exhibited a specimen of the Hackled Pigeon (*Alectorœnas nitidissima*) recognised, last September in the Museum of Science and Art in Edinburgh, by Prof. Newton, F.R.S., M.A., who made some remarks on the species showing (1) that it was peculiar to Mauritius, (2) that it is now wholly extinct, and (3) that only three specimens of it are known to have been preserved.—The Secretary read an extract from a letter received from Commander Hoskins, R.N., of H.M.S. *Wolverine*, on the subject of the range of the Mooruk, stating that no traces of the existence of this bird could be found in New Ireland.—An extract was read from a letter addressed to the secretary by the Rev. George Brown, giving additional particulars on the same subject.—The Secretary read an extract from a letter addressed to him by Mr. R. Trimen, F.Z.S., of Cape Town, on the subject of the true locality of the Black Spurwinged Goose (*Plectropterus niger*), which he had ascertained had been brought to Cape Town from Zanzibar.—A communication was read from Dr. Morrison Watson and Dr. Alfred H. Young, on the anatomy of the Spotted Hyæna (*Hyæna crocuta*).—A communication was read from Mr. A. D. Bartlett, giving an account of the habits and changes of plumage of Humboldt's Penguin, as observed in a specimen which had been recently living in the Society's Gardens.—A communication was read from Dr. O. Finsch, C.M.Z.S., containing an account of a collection of birds made by Mr. Huebner, on Duke of York Island and New Britain.—A communication was read from Mr. Edward J. Miers, F.Z.S., describing a collection of crustacea, made by Capt. H. C. St. John, R.N., in the Corean and Japanese Seas. The present paper related to the Podophthalmia of the collection, of which groups twenty-six species were described as apparently new to science.—A communication was read from Count T. Salvadori, C.M.Z.S., containing critical remarks on Mr. Elliot's paper on the Fruit-pigeons of the genus *Ptilopus*, lately published in the Society's *Proceedings*.—A communication was read from the late Marquis of Tweeddale, F.R.S., containing the twelfth of a series of contributions to the ornithology of the Philippines. The present paper gave an account of the collection made by Mr. A. H. Everett in the Island of Basilan.—Dr. A. Günther, F.R.S., gave an account of the mammals, reptiles, batrachians recently collected by Mr. Everett in the Philippine Islands, and called special attention to a new form of snakes of the family Calamariidæ, of which one example had been obtained. This snake, which was remarkable as possessing no external rudiments of eyes, was proposed to be called *Typhlogeophis brevis*.

Mineralogical Society of Great Britain and Ireland, January 7.—General Meeting.—Mr. H. C. Sorby, F.R.S., president, in the chair.—The following papers were read or taken as read:—On pilolite, an unrecognised species, by Prof. M. F. Heddle, M.D.—On so-called green garnets from the Urals, by Prof. A. H. Church, M.A.—On the magnetism of rocks and minerals, by J. B. Hannay, F.C.S.—On the celestine and baryto-celestine of Clifton, by J. N. Collie, communicated by W. W. Stoddart, F.G.S.—On some silicates of copper, by Wm. Semmons, president of the Liverpool Geological Society.—Contributions towards a history of British meteorites, by T. M. Hall, F.G.S.—Notes on some crystals of iron, by Amos Beardsley, F.G.S.—Notes on massive and crystallised cronstedite from Wheal Jane, by A. K. Barnett, F.G.S.—A large number of Members and Associates were elected by the Council previous to the meeting.

EDINBURGH

Royal Society, January 6.—Prof. Kelland, president, in the chair.—Mr. James Blyth gave notes on some experiments with the telephone. When the ends of two wires attached to the telephone were rubbed against one another and kept at a high temperature a grating sound was heard in the telephone, which diminished as the temperature was lowered. The sound, however, did not quite cease when the ends of both wires were cold. In this case the sound was louder and more distinct when the wires were attached to two files which were rubbed against each other. The experiment was modified by attaching one wire to the file and the other to a vice. Different substances—brass, carbon, zinc, iron, steel—were then screwed into the vice and rubbed by the file, but not much difference was observed between the effects produced. Another modification consisted in attaching the second wire to the axle of the fly-wheel of a lathe. In the last case the sound was very loud and distinct when the file attached to the other wire was held hard against the wheel as it revolved. A sound was also heard in the telephone when a hammer was made to strike a body—the hammer and the body being each connected to one of the telephonic wires. The sound was distinct but not so loud as with the rubbing. The sound was very loud when a large toothed wheel driven fast was used, and against which a strong spring struck, the one wire being attached to the wheel the other to the spring. Here there is a combination of striking and friction. Mr. Blyth suggested that these currents might be due to thermo-electric action or might be the electricity which Sir Wm. Thomson considers as the probable cause of friction.[1] The experiment was again varied by connecting one wire to the style of a phonograph and the other with the screw; there were two Bunsen cells in the circuit, which was completed by the style and cylinder. When the phonograph was spoken into, a person in a distant room could hear by means of the telephone. This seemed to show that the style presses unequally on the tinfoil and hence that although magnified copies of the curve on the tinfoil may be obtained by multiplying levers, these copies do not necessarily represent the motion of the style.—Prof. Tait gave a note on the measurement of beknottedness. The former measure was the smallest number of crossings whose signs must be changed to take off all the knotting. An objection to this was that these seemed to have no direct connection with the electro-magnetic measurement. The new method consists in drawing the knot in two parallel curvilinear lines easily distinguishable from each other by colour or formation, the one knot being thus wholly within the other. A knot is cut across through the symmetrical angle, and the ends joined again.—Prof. Tait gave a preliminary note describing some experiments

[1] Bakerian Lecture, 1856, *Phil. Trans.*, foot-note to second page.

he was making for the purpose of measuring what is known as the "Thomson Effect," viz., the convection of heat by electric currents from a cold to a hot part of a bar, or *vice versâ*. The method had occurred to him while testing the electric conductivity of bars heated for Forbes' conduction experiment.—A paper was read by Dr. Macfarlane and Mr. P. M. Playfair, on the disruptive discharge of electricity, in confirmation of former experiments of a similar nature. They found former anomalies with sparks of more than a certain length between two spheres, to be due to discharge by small sparks, and beyond that to escape into the air from the insulated wire. In the case of discharge between a plate and a point, there was a gradual increase in the difference of potential. Up to a certain limit the sparks were white; beyond that the sparks were violet, and there was very slight increase in the difference of potential required. On discharging through solid paraffin it was found that the first spark was by far the largest, and on examination the paraffin was found perforated in a zigzag manner, and the sides of the perforation were charred. The solid paraffin had twice as great electric strength as the same paraffin in the liquid state, and five times the electric strength of air. They found that the electric strength was a very definite method of distinguishing between different paraffins, but somewhat difficult of application.—Prof. Tait showed some pieces of sheet or tape india-rubber which Mr. Maclachlan of Mitcham had used to insulate wires, and which, after being stretched for some years, were found to be permanently strained; but they immediately regained their former dimensions on being dipped into hot water. The same phenomenon was true, he found, of india-rubber which, while warm, was stretched out nearly to rupture, and then kept stretched till cold. Prof. Clerk Maxwell had found a similar property true of gutta-percha pulled out when cold after being boiled. On heating it before a fire it took a peculiar form.

VIENNA

Imperial Academy of Sciences, December 5, 1878.—On twins; a contribution to human physiology, by Dr. Göhlert.—On the diffusion of liquids, by Prof. Stefan.—Determination of the path of the third comet of 1877, by Herr Zellr.

December 12, 1878.—On the fish species in the two lakes of Lower Austria, the Erlaph and Lunzer Lakes, by Dr. Fitzinger.—New observations on sounding air columns, by Prof. v. Lang.

PARIS

Academy of Sciences, January 13.—M. Daubrée in the chair.—The following papers were read:—On the construction of bridge-arches realising the maximum of stability, by M. Villarceau.—Researches on ozone and on the electric effluve, by M. Berthelot. Oxygen (1 vol.) and hydrogen (2 vols.) do not combine under action of the effluve, though the tension be nearly that which gives, through air, sparks 7 to 8 ctm. long. O will combine with the metals, sulphurous acid, nitrogen, &c., under such conditions. CO (2 vols.) and O (1 vol.) combine under like tensions; but the reaction is incomplete; and even with excess of O it is so. The effluve, acting on a mixture of CO_2 and O partly decomposes the former, and the O contains ozone; acting on pure CO_2 in a space without mercury or oxidable bodies, the effects point apparently to the existence of percarbonic acid.—On the formation of ethers of hydracids in the gaseous state, by M. Berthelot.—Are there, among low organisms, species exclusively *aërobies* and others exclusively *anaërobies?* Should all these beings be ranged in two or three classes (Pasteur) or in one only? by M. Trecul. He argues for one class only, each species being capable of presenting at once one or several *aërobian* states, and one or several *anaërobian*.—Reply to M. Berthelot, by M. Pasteur.—Researches on the compressibility of gases, by M. Cailletet. He describes the manometer he uses; a tube of soft steel wound helically round a vertical cylinder, by turning which the tube is sent down a deep pit or wound up again. The lower end of this tube is connected with a laboratory-tube, in which is inclosed the piezometer containing the gas, and mercury is introduced into the apparatus. This tube is suspended by a fine graduated steel wire, the length of which unrolled measures the pressure. M. Cailletet tabulates his numerical results with nitrogen, which, it appears, contracts at first more than according to Mariotte's law; its compressibility then decreases (as in the case of air). It is about a pressure of 70 metres of mercury, that the gas presents this curious maximum.—The polymorphism of *Agaricus melleus*, Vahl., by M. Planchon.—Experiments relating to the action of waves on beaches and on artificial rock-work, by M. De Caligny. He reproduces in an artificial canal effects noticed at the rock-work of Cherburg, where large waves which, at low water, rolled the blocks towards the summit of the talus, had an undermining effect at high water.—M. Monot presented some specimens of results he has obtained in manufacture of various kinds of crystal.—The phylloxera in Panama, on the *Vitis caribæa*, D.C., by M. Collot.—On the employment of oil of asphalte against phylloxera, by M. Berton. Some one told him, when exploring the Dead Sea, that this oil had saved the vineyards of Judea from a worm (phylloxera?).—Letter to the President of the Commission on phylloxera, by M. Truchot.—MM. Felson and Chartre communicated a detailed catalogue of those erratic blocks most remarkable as regards the history of glacial phenomena.—The General-Inspector of Navigation presented data concerning flood and low-water of the Seine in 1878.—Observations of Saturn's satellites, at the Observatory of Toulouse, in 1877 and 1878, with the large Foucault telescope, by M. Baillaud.—New compound prism for direct-vision spectroscope of very great dispersive power, by M. Thollon. This sulphide of carbon prism is closed laterally by crown glass prisms, whose refringent angles are in opposite direction to that of the sulphide. The compound prism gives the enormous dispersion of 2°·0 angular distance of the D-lines, as compared with 45″ for sulphide of carbon. Substituting the new prisms in his former spectroscope, he got a dispersion equivalent to that of 16 sulphide of carbon prisms of 60°, or 31 prisms of index 1·63. It gave 12′ angular distance in the D-lines, and it presents quite new aspects of the spectrum. All the lines (newly) resolved were found to belong to different substances.—On M. Thollon's spectroscope, by M. Laurent.—On determination of the variations of level of a liquid surface, by M. Renou. A claim of priority.—Synthesis of uric derivatives of the series of allophane, by M. Grimaux.—Action of diastase, saliva, and pancreatic juice on starch and glycogen, by MM. Musculus and De Méring.—New observations on the development and metamorphoses of Taenias, by M. Megnin. Certain unarmed and armed Taenias are two adult forms of the same worm, their differences due exclusively to the conditions of their development.—Observations on Majorca and Minorca (continued), by M. Hermite.—New observations on the danger of use of powdered borax in meat-preserving, by M. Le Bon.

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